

downward facing louvers, **21**. On the interior face thereof, is a filter holder frame **36**, which is of an open box configuration and mounted to the interior of door **12C** by bolts **37**. A series of upward facing louvers are seen disposed in face **36A** of the frame **36** offset from the door surface. These louvers **38** face upward. Disposed between frame **36** and the interior surface of door **12C** is a filter media such as spun metal. The area of the filter frame is coextensive with the area of the downward facing louvers on the front surface of door **12C**. Thus there is air flow through the grill **35** of the outer door through the exterior louvers **21**, through the filter media **39**, through the inner louvers **38** into the transformer area.

[0067] FIG. **19** is a front elevational view of the apparatus with all inner and all outer doors removed. The view is from the front of the apparatus. In the left compartment **13**, are seen

[0068] a pair of spaced back panels mounted to the floor of the compartment upon which are mounted electrical components needed for the operation of the VFD, such as but not limited to the Toshiba HX7 Plus, designated **42**. The VFD is suitably mounted in the compartment according to the specification of the manufacturer.

[0069] On the rear wall **27** of compartment **13** a fan mount board with an opening therein, unseen, and which opening is covered over by the presence of fan **44**. The fan's purpose is to blow air through the heat sink of the Variable Frequency Drive.

[0070] In the transformer compartment **14**, an 18 pulse transformer, **45**, matched from the vendor is mounted to the floor of the compartment **14**. A pair of vertically spaced conventional component mounting bars are conventionally attached to the opposed sidewalls of the compartment **14**. To these bars **49**, the main circuit breaker **50** is physically mounted.

[0071] At this point a timeout is taken to advise the reader that all the electrical components, fans, the VFD, the transformer and the interlocks to trigger the main breaker are electrically connected either according to the specification of the manufacturer or as would be done conventionally. However the details of the electrical connections will not be recited as such are beyond the purview of this patent application whose subject matter primarily is the cabinet for housing the VFD and transformer to operate in the environment as set forth previously, that is without the need for refrigerated air.

[0072] On the rear wall **29** of compartment **14**, a fan mount board **47** having two horizontally spaced fan circular cutouts therein **48** is attached to the rear wall **49**. Two eleven inch cooling fans not seen, are to be attached to these openings.

[0073] We now turn to the rear wall exterior faces, **27** & **32** respectively of the two compartments **13** and **14**. FIG. **20** depicts the rear wall of the unmodified NEMA 3R cabinet referred to infra. It is simply two painted metal sheet metal panels, and nothing else.

[0074] We now move to FIG. **21**, which shows the modified rear exterior panels, **27,29** of the compartments **13** & **14** respectively. The VFD, the larger of the two compartments has an enclosure **28**, mounted over a suitable opening in and extending away from rear wall **29**. The two side walls **28**, per FIG. **12** have a series of downward facing louvers thereon. On the rear surface thereof **28R** on opposite ends of the enclosure there are also a series of downward facing louvers,

51 and **52**. Between these spaced louver sets is the space for the integral heat sinks of the VFD, not seen.

[0075] The transformer compartment enclosure **30** is mounted in a suitable opening in the rear wall **29** of the compartment **14**. Here too from the outside a series of downward facing louvers are seen. Behind these louvers will be found the two 11 inch fans mentioned previously, the space for which is seen from the front vantage point in FIG. **19**. Thus hot air exits the transformer compartment from the fans and blows out through the louvers. Whereas in the VFD compartment's enclosure **28**, cool external air is sucked in through the louvers on the right in the rear vantage point, designated **51**, as well as the right side surface of the enclosure, **53** blows across the VFD heat sink, and exits out the louvers on the left end of the enclosure, **52** and the louvers **54** on the left side of the enclosure **28** as seen in FIG. **12**.

[0076] The discussion now moves to FIG. **22** Here the two enclosure have been unbolted from the rear walls of their respective compartments. This FIGURE should be viewed in conjunction with FIGS. **18** and **19** for full understanding. In rear wall **23** of the transformer compartment one sees part of the transformer **45** and the louvers **38** of the interior surface of the inside door. See FIG. **18**. The main circuit breaker **50** and its mount beams have been removed for ease of seeing the louvers aforementioned.

[0077] In the opening from which enclosure **28** was removed one can see cooling fan **54** and the large heat sink **55**.

[0078] FIG. **23** is related to FIG. **22** in that for the larger compartment, the airflow is illustrated by arrows **56** which move from the side throat of the heat sink fan **54**, across the heat sink **55**. Whereas in the left compartment of the transformer the mount board **47** for the two 11 inch fans has been put back in place, per FIG. **19**.

[0079] Thus the apparatus aspect of the invention which relates to the modification of the Tesco Controls Nema 3R cabinet has been completed. The discussion now moves to the process aspect of this intention.

Process for Cooling Instrument Locations

[0080] As noted above the object of this invention is to create a storage cabinet for the variable frequency drive, such that no refrigeration is required to permit the apparatus to operate in the exterior within a large operating temperature parameter. Thus this apparatus must be able to operate without in the heat of Palm Desert Calif. or the cold of Truckee Calif. in the high Sierra mountains at about 7000 feet elevation.

[0081] Determine the high temperature operating parameter for determining cooling requirements and the low temperature operating parameter to determine if any insulation within the cabinet compartments will be needed for the VFD and transformer of choice.

[0082] Thus the first step is to determine the cubic footage of the VFD compartment and the cubic footage of the transformer compartment. Next, calculate the space occupied by the components present in each of the two compartments.

[0083] Third, calculate the airflow around the components in each compartment based on the scfm (Standard cubic foot per minute) characteristics of the blower fans available for installation in the cooling enclosures attached at the rear of each compartment. Then fourth, estimate the direction of